

Section 83 Railings and Barriers

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4-8301 General

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Railings and barriers are used to reduce the severity of run-off-the-road accidents, to prevent out-of-control vehicles from crossing the median, and to decelerate errant vehicles. Construction personnel involved in the installation of railings, barriers, and other traffic safety systems should be familiar with Chapter 7, “Traffic Safety Systems,” of the *Traffic Manual*.

The following paragraphs discuss some of the details considered during design. The discussion centers on metal beam guard railing but can be applied to other types of railings and barriers.

The design for guardrail with end anchors contains many subtle details, the basis for which may not be readily apparent. Pay special attention to all connection details.

Impact tests and automobile configurations show that the specified height of 29 inches to 30 inches is necessary to prevent errant vehicles from climbing over the guardrail. Spacing posts 6 feet 3 inches apart provides resistance to guardrail deflection on impact and lessens the tendency of the guardrail to form a pocket during impact.

A block spaces the guardrail out from the post. As a result, the contact area is moved away from the post so that little possibility exists of a vehicle snagging on the post. The block allows the guardrail to rise slightly on initial impact, reducing a vehicle’s potential for rolling.

When timber shrinks, it introduces enough slack in the mounting bolts to allow the timber blocks to rotate. Toenailing the blocks prevents this rotation.

When timber posts are used, do not use washers on the rail face so the bolts can pull through when a vehicle strikes the guardrail. During installation, the square hole in the plate washer will keep the carriage bolt from rotating.

The metal box spacer used at transitions to a concrete barrier or wall allows the guardrail to approach the barrier on a straight line and minimizes the possibility of vehicles snagging on the end.

Frequently, when lateral clearances are limited, the plans and special provisions specify a proprietary end terminal system. When the terminal system is required, be sure to install the system according to the manufacturer’s instructions.

4-8302 Before Work Begins

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Take the following steps before work begins:

- Carefully review the required details, and make sure construction conforms to them. Review the locations in the field, and decide whether changes are necessary.



- If drainage inlets or other obstructions conflict with the planned locations for guardrail posts, consider using long-span, nested guardrail. Refer to Chapter 7-03.5, “Design Considerations,” and Figure 7.9, “Long Span Nested Guardrail,” of the *Traffic Manual*. Consult with the district traffic engineer for information. If the contract does not provide for long-span, nested guardrail, you will need a change order.
- Verify the receipt and proper distribution of form CEM-3101, “Notice of Materials to Be Used,” which lists all fabricated materials. Examine the material as it arrives on the project to ensure that it meets specifications. Refer to Table 6-2.1, “Inspection of Fabricated and Manufactured Materials” in Section 6-2, “Acceptance of Manufactured Material and Sampling Methods,” of this manual.
- Look for the identification tags or markings that indicate the Office of Materials Engineering and Testing Services (METS) previously inspected the materials. If the materials are properly identified as inspected, project personnel do not need the certificates of compliance or mill test reports. Normally, the METS inspector will have obtained these documents.
- Ensure that markers and delineators for railings and barriers are the correct type and are covered by a certificate of compliance in accordance with the section titled “Prequalified and Tested Signing and Delineation Materials” in the special provisions.
- Review the contractor’s stakes and layout work. Ascertain that offsets and flares for guardrail will be installed as shown on the plans.
- When connections to structures are required, coordinate this task with the Office of Structure Construction.
- Ensure that all concrete mix designs have been approved before use.
- When applicable, discuss the allocation of work with the Office of Structure Construction.
- Review all shop plans for metal railing on structures.
- To avoid possible conflicts, verify scupper, side drain, pull box, and conduit locations.

4-8303 During the Course of Work

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Once work begins, take the steps below for each type of railings and barriers:

4-8303A Metal Beam Guard Railing and Thrie Beam Barrier

For this type of guardrail and barrier, do the following:

- Measure wood posts at the jobsite to be sure they conform to specifications.
- When required, ensure that bolt holes in treated posts are filled with grease. Note this inspection in the daily report.
- Be sure that the backfilling of postholes conforms to specifications. Posts should be set to the full depth shown on the plans. When spread footings or other underground obstructions interfere with placing at full depth, refer to the Standard Plans for alternatives.
- Periodically measure the spacing of posts.



- Ensure that wood blocks for metal beam guard railing are toenailed to timber posts.
- Make sure rail elements are lapped so that the exposed ends will not face approaching traffic. Check bolts for tightness and threaded rods for proper trimming.
- Measure the height of the guardrail and barrier above the ground or finished grade to ensure that the height conforms to the plans.
- Be sure that connections to bridge railings, retaining walls, abutments, or other flat surfaces comply with specifications. When high-strength bolts are required, check markings on the bolts to ensure that they match specifications. When necessary, consult with district laboratory personnel about the proper markings.
- Ensure that anchor assemblies are constructed as specified. Install cable clips in the proper direction and tightened to the required torque. When a sample cable is required for testing, the METS inspector will normally have obtained one with swaged fitting. So if cable is properly identified as previously inspected, project personnel do not need to obtain a sample.
- When posts are installed in loose soil or near embankment edges, longer posts or some design modifications may be necessary to ensure a barrier with adequate strength. Refer to Sheet A77FA in the Standard Plans.
- Immediately before placing concrete, ensure that holes for concrete anchors and footings are excavated to the dimensions shown on the plans.
- Make sure that anchor cables are tight enough to prevent any obvious slack in the cable once the footing concrete has cured for the required period.
- Direct the disposal of surplus material from excavation. When traffic uses an adjacent lane, prohibit spoil piles or windrows of material from remaining in front of guardrail or median barriers. Such material alters the effective height of the railings and barriers.
- Ensure that asphalt concrete dikes are positioned under the guardrail as shown on the plans.
- Bolts or threaded rods must be long enough so the nuts are completely threaded onto the bolt. Make sure that no more than one-half inch of thread is exposed on the traffic side of the guardrail as shown on the plans.
- Ensure that the construction of flares conforms to the plans.
- Keep adequate records and make sufficient measurements to support both partial and final payment.

4-8303B Pipe Handrailing, Steel Bridge Railing, Cable Railing.

For metal railing (tubular), and chain link railing, do the following:

- Ensure that materials and methods used in anchorage and connections conform to the specifications and plans.
- Make sure the contractor connects, stretches, and tightens cables, chain link fabric, and tension wires as required.
- Check railings for proper alignment, appearance, and workmanship.



4-8303C Concrete Barriers and Railing

Do the following for concrete barriers and railing:

- Prohibit the placement of concrete barriers or railing on new structures until the falsework is released. The Office of Structure Construction will provide height adjustments to compensate for camber and dead load deflections.
- Review the specifications for closing temporary gaps in barriers during construction. Determine that the contractor has planned this work before removing existing barriers or constructing new barriers. Be sure blunt ends exposed to traffic are adequately protected. Refer to the “Public Safety” section in the special provisions.
- Ensure that forms comply with Section 51-1.05, “Forms,” of the *Standard Specifications*. For additional guidelines, see Section 4-51, “Concrete Structures,” of this manual.
- When extrusion or slipform machines are used to construct concrete barriers, inspect the grade on which the machine will ride to determine if the grade is smooth enough to prevent foreseeable violations of specified tolerances. Check guide wires for obvious variations or measurable sags between supporting stakes.
- Ensure that the placing of bar reinforcing steel conforms to specified requirements and the details on the plans. For guidelines, see Section 4-52, “Reinforcement,” of this manual.
- Review applicable specifications for producing, placing, finishing, and curing portland cement concrete to be used in concrete railing and barriers. For guidelines, refer to Sections 4-51, “Concrete Structures,” and 4-90, “Portland Cement Concrete,” of this manual.
- Require stripping the forms for Type 50 and Type 60 series barrier early enough so the concrete surface may be given a light brush finish without resorting to tempering with grout.
- During the placing of extruded or slipform barriers, the design of the concrete and placing method should require no hand finishing other than a light brush finish. The surface of the traffic side of the concrete median barrier should be as smooth as possible. Prohibit heavy brooming or other activity that will leave a roughly textured finish.
- Observe the abrasive blast finish applied to Type 50 and Type 60 series concrete barriers. The surface should have a uniform appearance without heavy texturing.

4-8304 Measurement and Payment

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Measure railings, barriers, and terminal systems as specified and, where appropriate, to the limits shown on the plans. Also, count to determine the number of cable anchor assemblies and connections to be paid for.

